

Claims

- [c1] 1. An apparatus for controlling a fluid discharge through an opening in a conduit, comprising:
- (a) a conduit section including a conduit inlet, a conduit interior, and a conduit exterior, said conduit section also including a conduit outlet having a continuously curved perimeter surface defining said conduit opening that includes oppositely disposed concave sections and oppositely disposed convex sections, wherein said concave and convex sections are continuous, said convex sections are operational to help reduce fan out of the discharge fluid from said conduit opening;
 - (b) a first arcuately curved gate member and a second arcuately curved gate member;
 - (c) means for rotatably mounting said first and second gate members externally to said conduit, said first and second gate members are operational to move from a fully closed position to a fully open position, said first and second gate members in the fully closed position are adjacent to said conduit outlet and have an adjacent interface to each other, as said first and second gate members transition to the fully open position from the fully closed position said first and second gate members

remain adjacent to said conduit outlet, said first and second gate members transitioning substantially symmetrically from the fully closed position to the fully open position remaining adjacent to said concave sections in the fully open position;

(d) means for moving said first and second gate members between the fully closed position and the fully open position, wherein said first and second gate members are operational to control the fluid discharge through said conduit outlet; and

(e) means for substantial fluid sealing between said conduit outlet and said first gate member, between said conduit outlet and said second gate member, between said first and second gate members, and between said first and second gate members interface and said conduit outlet, when said first and second gate members are in the fully closed position.

[c2] 2. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 1 wherein said means for substantial fluid sealing between said conduit outlet and said first gate member, and said means for substantial fluid sealing between said conduit outlet and said second gate member includes a continuous gate seal adjacent to said conduit outlet, wherein said gate seal slidably contacts each of said first gate

member and said second gate member.

- [c3] 3. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 2 wherein said gate seal is formed from a seal bulb with a tangential extension, with said tangential extension affixed to said conduit outlet.
- [c4] 4. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 3 wherein said gate seal is constructed of neoprene and fluorocarbon.
- [c5] 5. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 4 wherein said seal bulb is relatively positioned to each of said first gate member and said second gate member such that said seal bulb is compressed about three sixteenths ($3/16$) of an inch as against each of said first gate member and said second gate member.
- [c6] 6. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 2 further comprising a conduit outlet flow ring positioned adjacent to an interior surface of said conduit, said conduit outlet flow ring forming a surrounding sidewall extending from and beyond said conduit outlet, said conduit outlet flow

ring not contacting said first gate member or said second gate member, wherein said conduit outlet flow ring is operational to help shield said gate seal from the fluid discharge.

[c7] 7. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 6 wherein said conduit outlet flow ring includes a plurality of apertures in said surrounding sidewall extending from and beyond said conduit outlet, said apertures positioned substantially within a range of about sixteen (16) degrees centered about a conduit X axis at said conduit outlet, said apertures are operational to help control a pressure of the fluid discharge between said conduit interior and a gate seal fluid chamber when said first and second gate members are approaching and stopping in the fully closed position.

[c8] 8. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 6 further comprising a plurality of elastomeric segments, each said elastomeric segment being about two (2) inches long positioned adjacent to said conduit outlet and said surrounding sidewall extending from and beyond said conduit outlet forming a gate seal fluid chamber, said elastomeric segments also positioned substantially centered lengthwise within a range of about sixteen (16) de-

grees centered about the conduit X axis at said conduit outlet, said elastomeric segment sized and configured to provide about an one sixteenth (1/16) inch clearance to said gate seal when said gate seal is compressed about one eighth (1/8) inch from said first and second gate members, said elastomeric segment is operational to provide said gate seal with a support.

[c9] 9. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 1 wherein said means for substantial fluid sealing between said first and second gate members is accomplished by a labyrinth interface utilizing a continuous elastomeric strip positioned parallel to said interface, wherein said elastomeric strip is partially axially compressed.

[c10] 10. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 9 wherein said labyrinth interface includes a first seat that is adjacent to said first gate member and a second seat that is adjacent to said second gate member, wherein said first and second seats contact forming a cavity that is sized and configured for said elastomeric strip.

[c11] 11. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 10 wherein said cavity is in the form of a portion of a right

triangle including two perpendicular sides and an angled side, said portion of a right triangle is substantially perpendicular to said interface, said angled side is operational to wedge said elastomeric strip into said cavity when said first and second seats contact when said first gate member and said second gate member move from an open position to the fully closed position.

[c12] 12. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 10 wherein said first seat and said second seat are constructed of materials selected from the group consisting essentially of brass, bronze, copper, and zinc.

[c13] 13. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 9 wherein said elastomeric strip is constructed of neoprene.

[c14] 14. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 1 wherein said means for substantial fluid sealing between said first and second gate members interface and said conduit outlet is accomplished by an elastomeric plug retained within said second gate member, wherein said elastomeric plug contacts said conduit outlet in conjunction with a portion of said interface.

- [c15] 15. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 14 wherein said elastomeric plug is constructed of neoprene.
- [c16] 16. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 14 wherein said elastomeric plug is formed to contact a gate seal adjacent to said conduit outlet and a labyrinth portion of said interface.
- [c17] 17. An apparatus for controlling a fluid discharge through an opening in a conduit, comprising:
(a) a conduit section including a conduit inlet, a conduit interior, and a conduit exterior, said conduit section also including a conduit outlet having a continuously curved perimeter surface defining said conduit opening that includes oppositely disposed concave sections and oppositely disposed convex sections, wherein said concave and convex sections are continuous, said convex sections are operational to help reduce fan out of the discharge fluid from said conduit opening;
(b) a first arcuately curved gate member and a second arcuately curved gate member;
(c) a pair of trunnions, each trunnion adjacent to an opposite side of said conduit exterior, a first set of support

arms attached to said first gate member, said first set of support arms also rotatably attached to said trunnions, and a second set of support arms attached to said second gate member, said second set of support arms also rotatably attached to said trunnions, said trunnions, first set of support arms, and second set of support arms are operational to move said first and second gate members from a fully closed position to a fully open position, said first and second gate members in the fully closed position are adjacent to said conduit outlet and have an adjacent interface to each other, as said first and second gate members transition to the fully open position from the fully closed position said first and second gate members remain adjacent to said conduit outlet, said first and second gate members in the fully open position remain adjacent to said concave sections in the fully open position;

(d) means for moving said first and second gate members between the fully closed position and the fully open position, wherein said first and second gate members are operational to control the fluid discharge through said conduit outlet; and

(e) means for substantial fluid sealing between said conduit outlet and said first gate member, between said conduit outlet and said second gate member, between said first and second gate members, and between said

first and second gate members interface and said conduit outlet, when said first and second gate members are in the fully closed position.

[c18] 18. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 17 further comprising a linkage that is pivotally attached to said first and second set of support arms, said linkage also slidably engaged to said conduit exterior, said linkage is operational to cause substantially equal and opposite movement of said first and second gate members.

[c19] 19. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 17 wherein said means for moving said first and second gate members between the fully closed position and the fully open position is accomplished by a linear actuator attached between said conduit exterior and pivotally attached to said first and second gate members.

[c20] 20. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 19 wherein said linear actuator is selected from the group consisting essentially of hydraulic actuators, pneumatic actuators, and mechanical actuators.

[c21] 21. An apparatus for controlling a fluid discharge

through an opening in a conduit according to claim 17 wherein each said trunnion that is adjacent to an opposite side of said conduit exterior is attached to said conduit exterior by a slidable lockable engagement that is operational to allow said trunnions to move substantially parallel to a longitudinal axis of said conduit section allowing a clearance to be set between said conduit outlet and said first and second gate members.

[c22] 22. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 17 wherein said means for substantial fluid sealing between said conduit outlet and said first gate member, and said means for substantial fluid sealing between said conduit outlet and said second gate member includes a continuous gate seal adjacent to said conduit outlet, wherein said gate seal slidably contacts each of said first gate member and said second gate member.

[c23] 23. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 22 wherein said gate seal is formed from a seal bulb with a tangential extension, with said tangential extension affixed to said conduit outlet.

[c24] 24. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 23

wherein said gate seal is constructed of neoprene and fluorocarbon.

[c25] 25. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 24 wherein said seal bulb is relatively positioned to each of said first gate member and said second gate member such that said seal bulb is compressed about three sixteenths ($3/16$) of an inch as against each of said first gate member and said second gate member.

[c26] 26. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 22 further comprising a conduit outlet flow ring positioned adjacent to an interior surface of said conduit, said conduit outlet flow ring forming a surrounding sidewall extending from and beyond said conduit outlet, said conduit outlet flow ring not contacting said first gate member or said second gate member, wherein said conduit outlet flow ring is operational to help shield said gate seal from the fluid discharge.

[c27] 27. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 26 wherein said conduit outlet flow ring includes a plurality of apertures in said surrounding sidewall extending from and beyond said conduit outlet, said apertures posi-

tioned substantially within a range of about sixteen (16) degrees centered about a conduit X axis at said conduit outlet, said apertures are operational to help control a pressure of the fluid discharge between said conduit interior and a gate seal fluid chamber when said first and second gate members are approaching and stopping in the fully closed position.

[c28] 28. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 26 further comprising a plurality of elastomeric segments, each said elastomeric segment being about two (2) inches long positioned adjacent to said conduit outlet and said surrounding sidewall extending from and beyond said conduit outlet forming a gate seal fluid chamber, said elastomeric segments also positioned substantially centered lengthwise within a range of about sixteen (16) degrees centered about the conduit X axis at said conduit outlet, said elastomeric segment sized and configured to provide about an one sixteenth ($1/16$) inch clearance to said gate seal when said gate seal is compressed about one eighth ($1/8$) inch from said first and second gate members, said elastomeric segment is operational to provide said gate seal with a support.

[c29] 29. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 17

wherein said means for substantial fluid sealing between said first and second gate members is accomplished by a labyrinth interface utilizing a continuous elastomeric strip positioned parallel to said interface, wherein said elastomeric strip is partially axially compressed.

[c30] 30. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 29 wherein said labyrinth interface includes a first seat that is adjacent to said first gate member and a second seat that is adjacent to said second gate member, wherein said first and second seats contact forming a cavity that is sized and configured for said elastomeric strip.

[c31] 31. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 30 wherein said cavity is in the form of a portion of a right triangle including two perpendicular sides and an angled side, said portion of a right triangle is substantially perpendicular to said interface, said angled side is operational to wedge said elastomeric strip into said cavity when said first and second seats contact when said first gate member and said second gate member move from an open position to the fully closed position.

[c32] 32. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 30

wherein said first seat and said second seat are constructed of materials selected from the group consisting essentially of brass, bronze, copper, and zinc.

[c33] 33. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 29 wherein said elastomeric strip is constructed of neoprene.

[c34] 34. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 17 wherein said means for substantial fluid sealing between said first and second gate members interface and said conduit outlet is accomplished by an elastomeric plug retained within said second gate member, wherein said elastomeric plug contacts said conduit outlet in conjunction with a portion of said interface.

[c35] 35. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 34 wherein said elastomeric plug is constructed of neoprene.

[c36] 36. An apparatus for controlling a fluid discharge through an opening in a conduit according to claim 34 wherein said elastomeric plug is formed to contact a gate seal adjacent to said conduit outlet and a labyrinth

portion of said interface.